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(56) Documents cited

GB A 2125204	GB 1563680
GB A 2111292	EP A2 0092168
GB A 2107106	EP A2 0092167
GB A 2105491	EP A2 0092166
GB A 2082368	EP A2 0092165

(58) Field of search
G5R

(54) Video disc playback system

(57) An interactive disc system is provided. Information representative of a first program content is provided together with information of a second program content on a record disc 12 having a single spiral track. When an interactive section of the disc is played the player 10 is provided with two pieces of information so that it may track the correct information. One piece is provided by the system user who selects 31 the sequence to be viewed. The other piece is the digital information 26 on the disc which tells the player where the program being transduced is and where the transducer has to go to be in the desired program. In one embodiment, the spiral track is formed as a groove on the disc surface and the stylus cooperatively engages the groove. In a further embodiment, the first program content is interlaced with the second program content and a kicker is automatically operated to follow the selected program throughout the remainder of the recording, as shown by the respective track series marked by circles, squares and triangles in Figure 2.

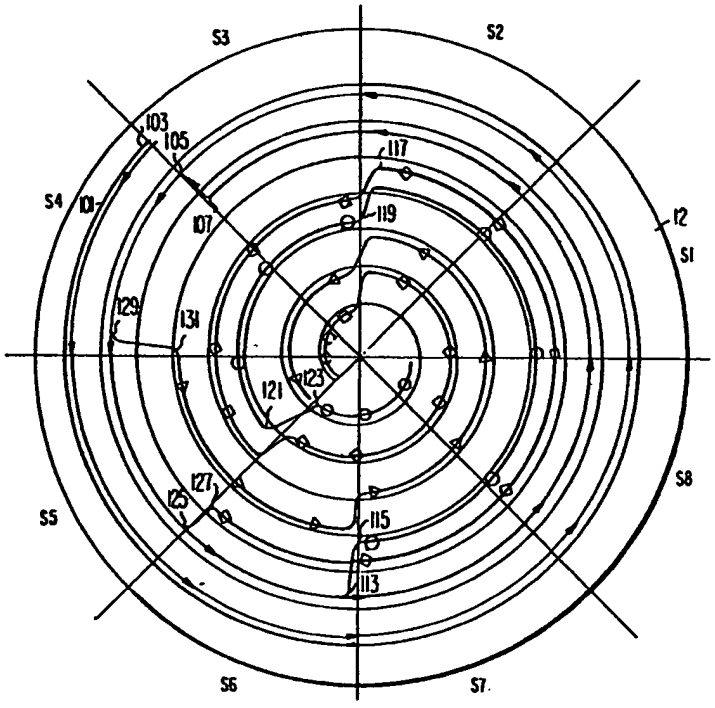

Fig.1

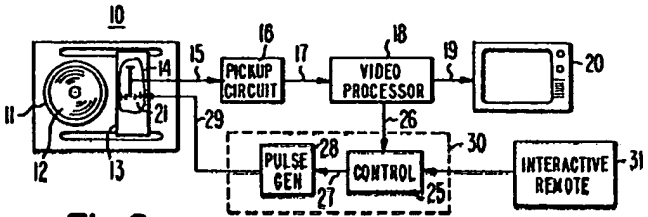

Fig.2

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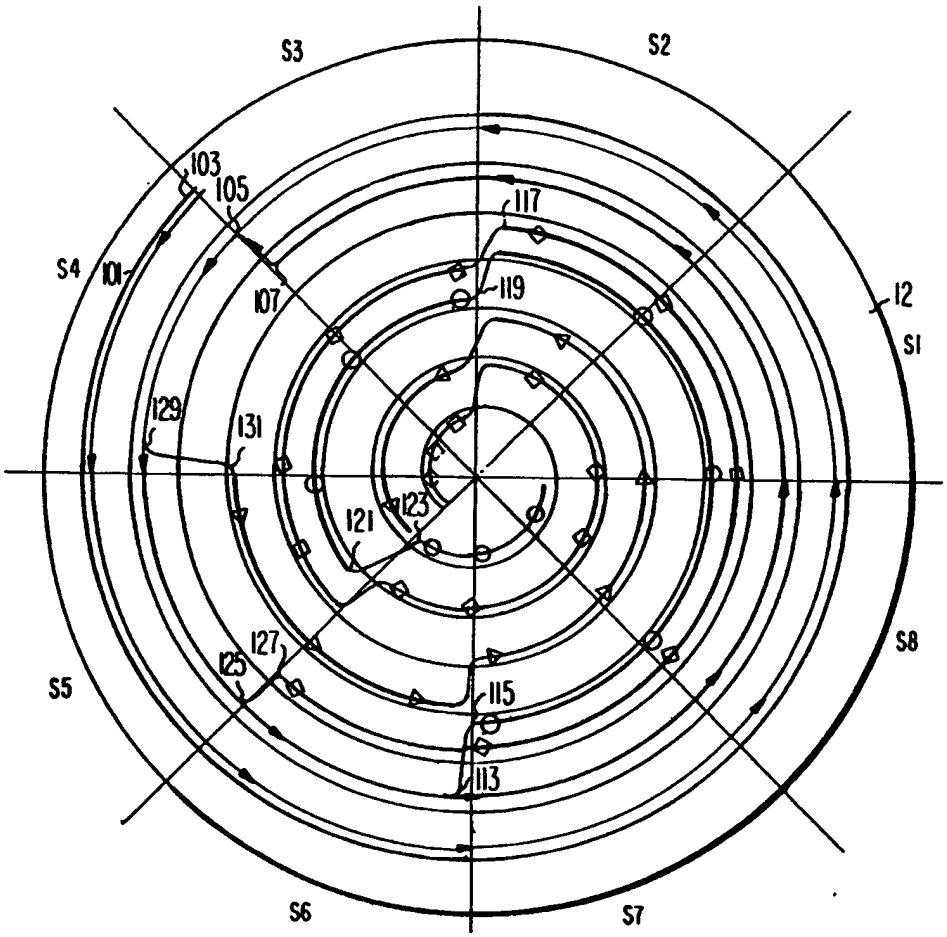
S3
S2
S4
S1
S5
S8
S6
S7
103
105
101
107
117
119
12
129
131
121
123
127
125
115
113

Fig.1

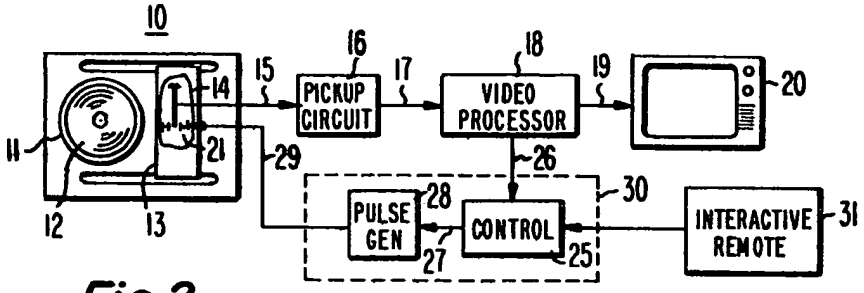

Fig.2

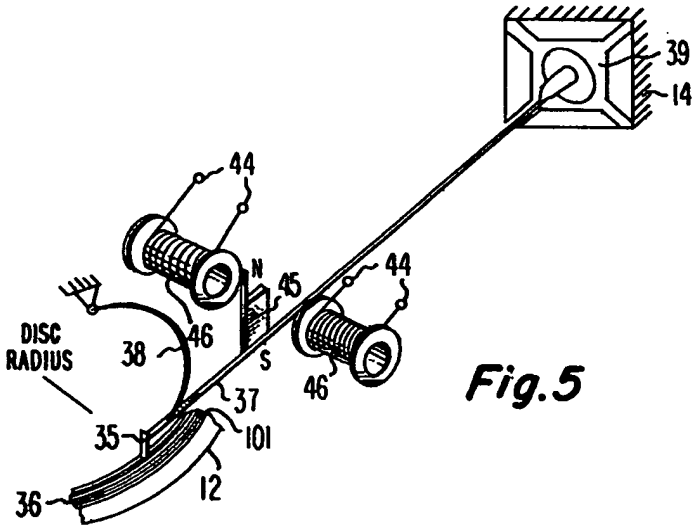

Fig.5

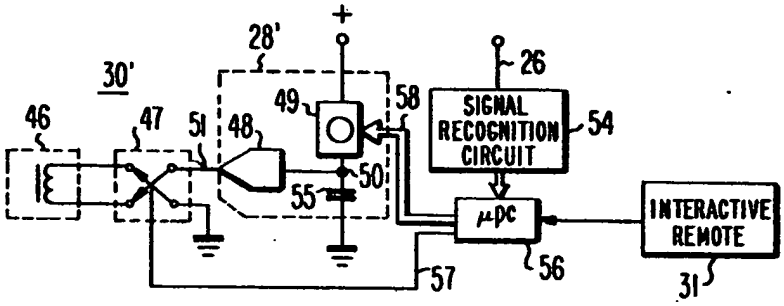

Fig.6

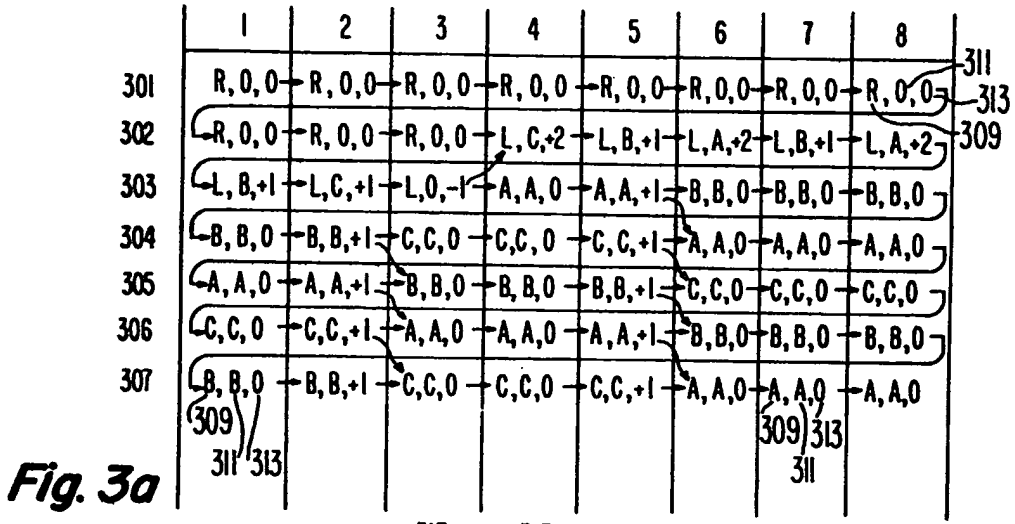

Fig. 3a

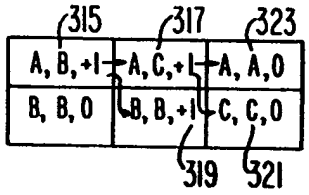

Fig. 3b

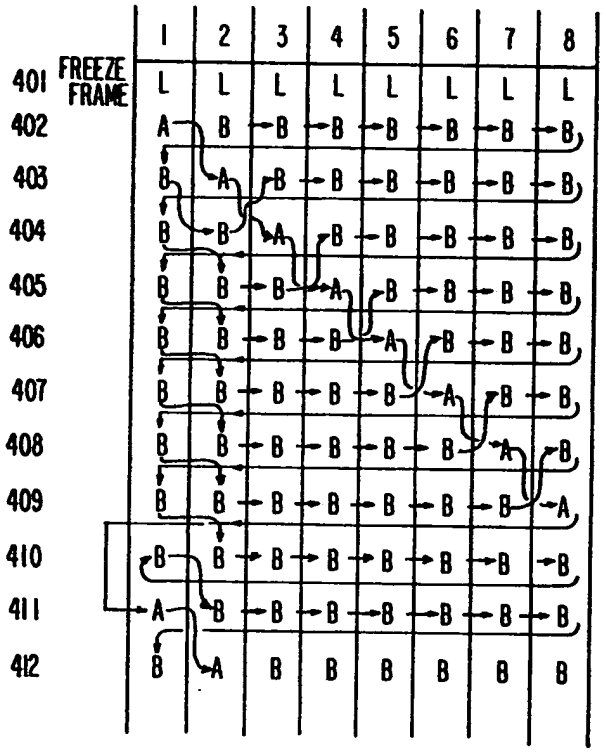

Fig. 4

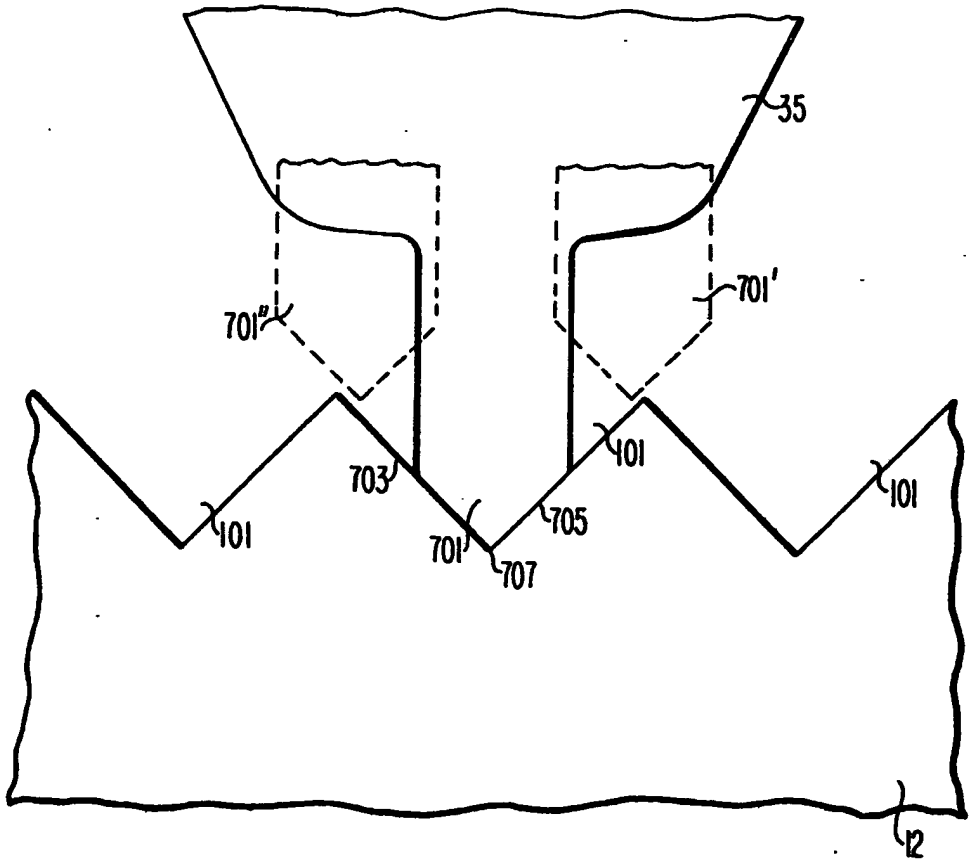

Fig. 7

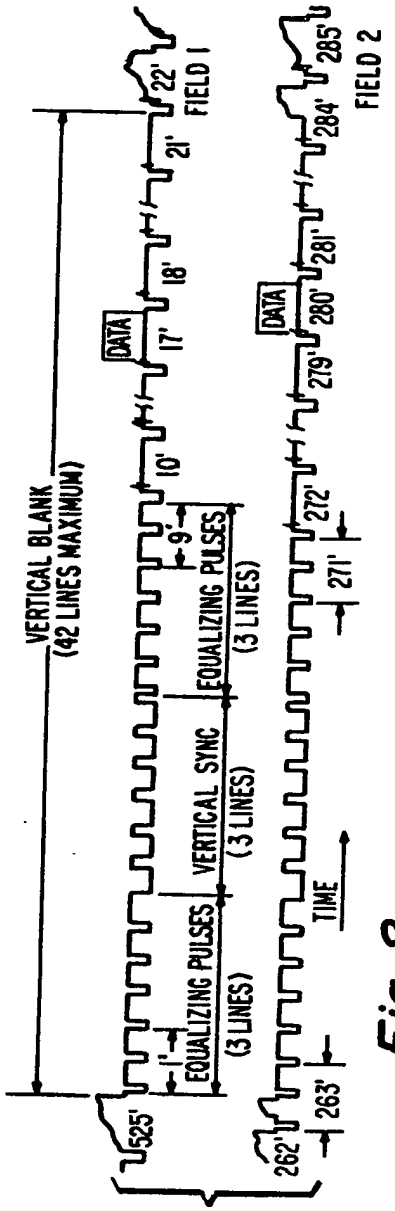
VERTICAL BLANK
(42 LINES MAXIMUM)
525'
1'
EQUALIZING PULSES
(3 LINES)
VERTICAL SYNC
(3 LINES)
EQUALIZING PULSES
(3 LINES)
9'
10'
DATA
17'
18'
21'
22'
FIELD 1
262'
263'
TIME
271'
272'
DATA
279'
280'
281'
284'
285'
FIELD 2

Fig. 8

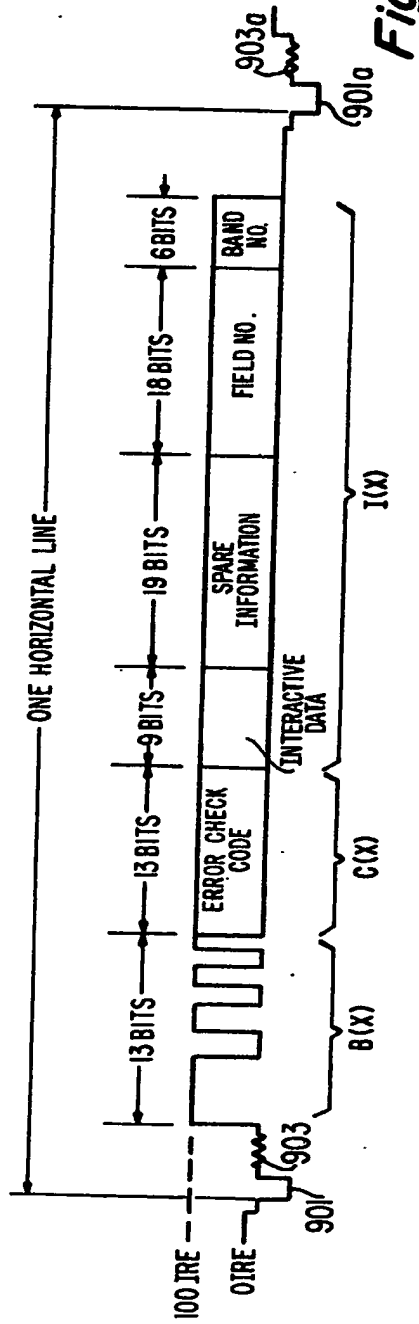
ONE HORIZONTAL LINE
100 IRE
0IRE
901
903
13 BITS
13 BITS
9 BITS
19 BITS
18 BITS
6 BITS
ERROR CHECK CODE
INTERACTIVE DATA
SPARE INFORMATION
FIELD NO.
BAND NO.
B(X)
C(X)
I(X)
901a
903a

Fig. 9

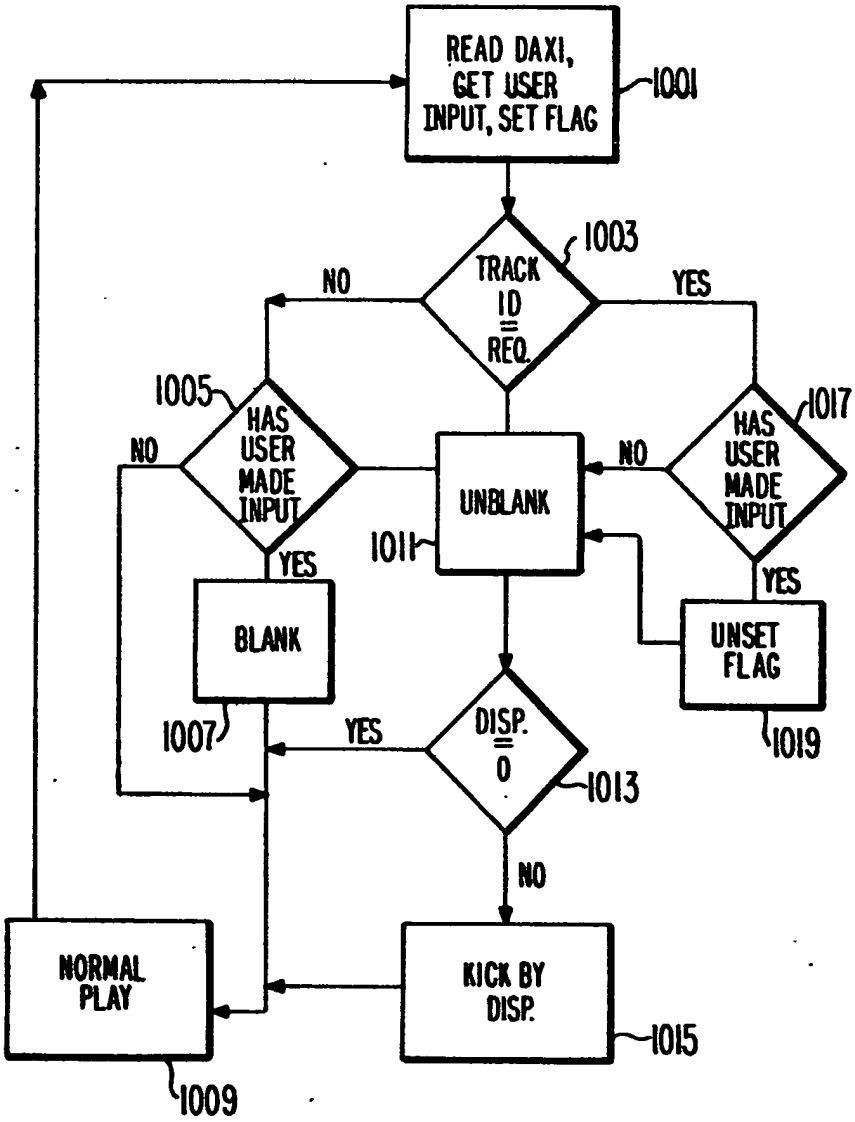
READ DAXI, GET USER INPUT, SET FLAG
1001
TRACK ID = REQ.
1003
NO
YES
HAS USER MADE INPUT
1005
NO
YES
UNBLANK
1011
HAS USER MADE INPUT
1017
NO
YES
BLANK
1007
UNSET FLAG
1019
DISP. = 0
1013
YES
NO
NORMAL PLAY
1009
KICK BY DISP.
1015

Fig. 10

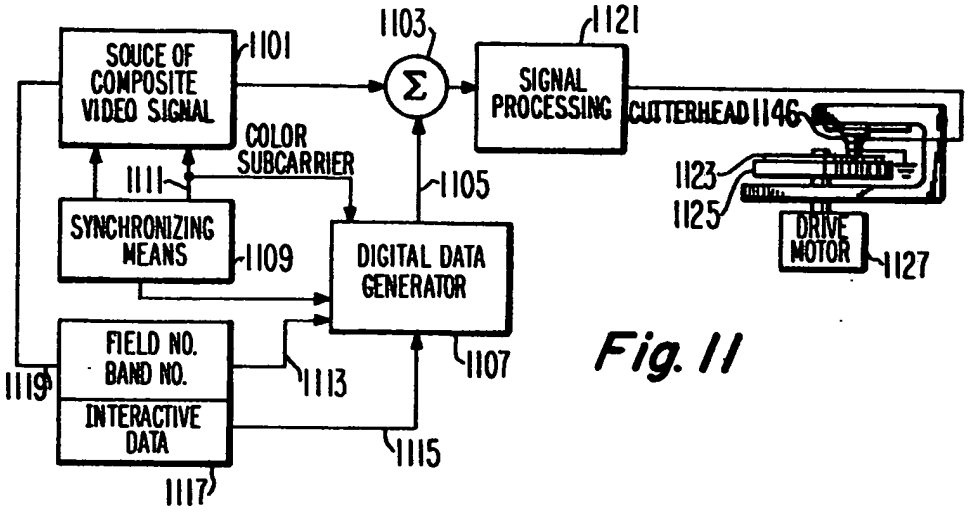

Fig. 11

1	2	3	4	5	6	7	8
R →	R →	FF →	FF →	FF →	FF →	FF →	FF,
FF →	FF →	FF →	FF →	FF →	FF →	FF →	FF,
FF →	FF →	P	A	B	C	D	E
F	G	H	I	J	K	L	M
N	O	BLANK	P	A	B	C	D
E	F	G	H	I	J	K	L
M	N	O	BLANK	P	A	B	C
D	E	F	G	H	I	J	K

Fig. 12

SPECIFICATION

Video disc playback system

The present invention relates to an interactive video disc system and, more particularly, to an interactive system for progressing through a plurality of separate programs, displaying a single program, in accordance with the instructions provided to the system from an external source, e.g., a viewer.

It is desirable to have an interactive video system wherein the displayed video and its sequence is chosen by the viewer. In a multiple story line system, for example, the television viewer may choose between a happy or sad ending to a program. In another arrangement, an interactive video system may be used for educational purposes wherein a question is presented, followed by a viewer response. After selecting a response the system reinforces or corrects the viewer depending upon the response selected. A third interactive system may be directed to a video game. For example, in a maze game the viewer selects a path from among several interconnecting paths to traverse a confusing maze network.

Prior art interactive systems have certain problems. In U.S. Patent No. 4,170,832, issued to Zimmerman, a tape based video teaching machine is described. In the Zimmerman system the tape is provided with control markers for accessing the video sequence responsive to the viewers action. In the Zimmerman system the responses are recorded in adjacent track longitudinally on the tape, e.g., four tracks. for immediate playback, i.e., after a choice has been selected by the viewer, the number of choices are limited to the number of tracks that can be recorded across the width of the tape. It is desirable to provide an interactive system having a greater number of choices at a branch point.

Near-continuous video can be provided by other interactive systems, however, generally these "fast" systems are expensive. For example, a system has been described wherein two video disc players cooperate to provide near-instantaneous branching. An exemplary disc format for a two player system is a city tour. For example, at the MIT Industrial Liaison Program Symposium held on January 15, 1980, intelligent video disc players were described. Here, as the one player provides a video sequence the other player has positioned its transducer for the next branch point. In city tour a two-disc interactive player #1 provides video to the viewer from one track while, the transducer of player #2 is positioned for the next branch. When the viewer is confronted with an intersection and asked to make a selection among three possible paths, Player #1's transducer is positioned to provide video for one path, say straight ahead, and Player #2, depending upon whether the transducer tracks forward or backward from the branch point, is positioned to provide video for the other choices, for example, a right turn selection or a left turn selection. This "fast" system is expensive requiring two synchronized players.

Other interactive systems are available which provide a greater number of choices for any branch point and are less expensive than a two player or two arm system, however, these systems have some drawbacks. Some disc systems provide interactive features by locating the branching data at locations remote from the branch point. That is the data which is selected by the viewer is remote with respect to the position of the transducer when the branch is initiated. These systems are generally inexpensive and provide a pluraity of responses, however, they do not provide near-immediate playback in response to the viewer's selection. After a selection has been made the transducer must search for the location of the selected response. The video, during the search, is generally blanked.

In the disc system according to one aspect of the present invention, a transducer is provided for reproducing information signals recorded in a spiral track in a disc-shaped record medium. Rasters of information are recorded in segments of the spiral track for producing a video display. Kicker means cooperate with the transducer, for effecting motion of the transducer so that the transducer skips from a first convolution where the transducer transduces the information signals prior to a skip to a second convolution where the transducer transduces the information signals subsequent to the skip. Branching means enable the transducer so that the transducer branches from a first raster sequence to a second raster sequence. Control means provide control signals for controlling the kicker means so that the kicker means urges the transducer to follow a predetermined path along the spiral track, whereby as the transducer follows the predetermined path, the second raster sequence selected by the branching means is displayed on the display means.

In accordance with a further feature of an example embodiment of the invention, the first sequence is interlaced with the second sequence so that when a branch is effected, near-continuous video is provided during the transition from the first sequence to the second sequence.

In the drawing:

Figure 1 is a plan view of a video disc record having a spiral track formed in accordance with one aspect of the present invention;

Figure 2 is a block diagram of a record disc playback system including a stylus kicker mechanism;

Figures 3 and *4* show illustrative record disc program formats in accordance with another aspect of the invention wherein the spiral track has been unfolded or developed for clarity.

Figure 5 is a diagrammatic representation of a stylus arm assembly having an electromagnetic kicker apparatus;

Figure 6 is a block diagram of a stylus kicker system;

Figure 7 is a diagrammatic representation of a video stylus tracking a conformal spiral groove in the surface of a video disc;

Figure 8 is a waveform diagram of the vertical blanking intervals preceding odd and even fields of a television signal;

Figure 9 is a representation of the digital data

format used for interactive tracking in an interactive video disc system;

Figure 10 is a flow chart illustrating a sequence by which the system of Figure 6 maintains the stylus in the desired track during interactive playback;

Figure 11 is a block diagram of a video disc encoder in accordance with a further aspect of the present invention; and

Figure 12 shows another record disc program format wherein sixteen different programs are recorded on the disc.

Referring to Figure 1 a disc record 12 for use in an interactive video disc player apparatus that has a turntable that rotates at a constant angular velocity is shown. Disc record 12 is divided into eight sectors S1 - S8. The information on the disc record is recorded in a spiral track 101 which is continuous from starting point 103 to ending point 104 across the surface of disc record 12. Each convolution of track 101 is divided into eight segments corresponding to the eight sectors of the disc record. Each segment of track 101 has one complete field of television signal recorded therein, thus in the disc 12 of Figure 1 there are eight fields or four frames of television signal per 360° of information track. The angular displacement for a field is 360/8 = 45° and 90° for a frame. It should be noted that the disc 12 of Figure 1 is merely illustrative, other systems such as systems which have two or four fields per revolution could be used with the present invention.

Referring to Figure 2, a video disc playback system is shown. Player 10 has a turntable 11 for rotatably supporting record disc 12. In the Figures, elements designated with like reference numerals are the same or similar items in the various Figures. Each convolution of spiral track 101 on disc 12 contains picture signal information inclusive of synchronization components and information identifying the particular convolution. A stylus assembly 14 including a signal pickup stylus mounted in carriage mechanism 13 for radial translation of the stylus assembly across record 12. A kicker assembly 21 is mounted in close proximity to the pickup stylus for imparting motion to translate the stylus over one or more convolutions of the track. Capacitance variations occurring between the stylus and the disc record are detected by pickup circuits 16 and applied to the video processor 18 to format the signal for display by a conventional television receiver 20.

For special effects (i.e., interactive) the signal pickup stylus traces a path across the surface of disc 12 in accordance with the instructions provided by a user input from an interactive remote control 31 and digital auxilary information (DAXI) recorded along with the picture signal information. In other words, the stylus is kicked in a "dancing" routine so that the video sequence recovered from the disc and displayed on receiver 20 is the sequence selected by the user. The stylus is caused to dance in response to the kicking pulses from kicker assembly 21. A kicker mechanism 30 includes control circuitry 25 responsive to the DAXI recovered in video processor 18 and the instruction signal provided by interactive remote 31 (user input). Pulse generator 28 generates a pulse of appropriate shape and/or amplitude to energize the stylus kicker 21 to translate the stylus a desired number of convolutions. Control 25 establishes the kick necessary to accomplish the stylus translation sequence required by the program selected by the user.

An example of one stylus dancing routine which may be practiced in accordance with the present invention will be described with reference to Figure 1. In this example assume that an American football game sequence is recorded on disc 12. The stylus tracks the spiral 101 beginning ar point 103 and proceeding inward. The football game is displayed on a television receiver. When the stylus reaches point 105 of spiral 101 (the beginning of the interactive material on disc 12) the stylus is caused to effect a freeze-frame mode by kicking back to point 105 from point 107 (the beginning of the next convolution). During this freeze-frame mode or prior thereto the user is instructed to select between one of three choices (of course, many other choices are within the capability of this system). In the American football example, the commentator for the football game may describe that the next video sequence shows the critical play of the football game and that the user may view this critical play from the 50 yard line, end zone 1 or end zone 2 by pushing buttons A, B or C, respectively, on remote 31. After the user selects a particular camera the player then initiates the stylus dancing routine to recover the selected sequence. For example, if the user selects the 50 yard line camera the stylus would skip from point 113 in freeze frame track to point 115 in track circle. To remain in track circle the stylus would skip from point 117 to point 119 and from point 121 to point 123 and so forth skipping over the diamond and triangle tracks which contain the other selections. If the user had selected the camera at end zone 1 or the camera at end zone 2 the stylus would follow the diamond (skip from point 125 to 127) or triangle (skip from point 129 to 131) tracks, respectively. In this interactive arrangement the program sequence for any choice (e.g., program a) is intermingled with the other programs (e.g., programs b and c). Advantageously, the stylus dancing arrangement permits almost instantaneous branching from one program to another which is not available in prior art interactive systems such as the type described above where the stylus must search for the next video which is recorded remote from the branch point. Further, this dancing arrangement may be implemented using a single player or a player with one transducer thus providing a relatively inexpensive interactive system.

Figures 3a is a representation of a program sequence wherein the track convolutions are folded out for ease of understanding. The disc sectors 1 - 8 are indicated at the top of the Figure. The convolutions are identified by reference numeral 301 - 307 shown on the left side of the Figure. The alpha-numerics shown in each block represent the information that may be recorded in the vertical blanking interval of a television signal. A specific embodiment for the alpha-numerics will be described with reference to Figures 8 and 9. The first alpha-numeric 309 is used to identify the position of the stylus (current

position of the stylus), the second alpha-numeric 311 is used to identify the track identification for the program to be played (future position of stylus) and the third alpha-numeric (signed) 313 provides the information concerning the number of convolutions to be skipped and the direction of skip (displacement). The disc is recorded on convolution 301 and 302, sectors 1, 2 and 3, with a regular program R. The track ID and displacement are both 0 indicating no skip to be effected. At convolution 302, sector 4 the program changes to a freeze frame mode. At convolution 303, sector 3 the track ID is 0 and displacement −1, thus the stylus will be kicked back one convolution into the freeze frame mode if the user has not altered the default track ID of 0. As noted above, the player will stay in a freeze frame mode until an input is received from the user. If the user selects program A, assuming the stylus is at convolution 303, sector 1 when the user message is received, the stylus will track convolution 303, sectors 1, 2 and 3 to convolution 303, sector 4. Thus the stylus tracks into program A, track I. D. A. If the user had selected program C a skip of +1 would have been effected at convolution 303, sector 1. Once the stylus has acquired a program A, B or C then it will follow that program in accordance with the displacement instructions provided in the vertical blanking interval.

Referring to Figure 3b a branching scheme for branching from a first program to second or third programs is shown. If the stylus is in position 315 recovering program A and the user selects program B the track I. D. B and displacement +1 in position 315 provides information of where the new program, i.e., B is located and how to get there, i.e., a displacement of +1 must be effected. So at the end of position 315 the stylus may continue to position 317 remaining in program A (no new instruction from user) or may skip to position 319 to recover program B (new instruction from user). If the user had selected program C the skip would be effected from position 317 to position 321, if no new instruction had been provided by the user then the sequence would be 317, 323.

Referring to figure 4 another program sequence is shown. In this sequence the stylus may take one of two paths (program A or B) when traversing the interactive material on the disc. If the user chooses the program A path the stylus skips to the next convolution after each field of video. If, on the other hand, the user chooses program B the stylus dances around program A to produce a different program sequence. According to this arrangement the user may choose to watch a regular program (i.e., program B) or to skip through the regular program and watch a short sequence of material (i.e., program A). In this arrangement shown program A would take 1/8 (skipping such that one field per revolution is transduced) of the playing time devoted to the interactive section of the disc while program B would take 7/8 of the playing time. An example of this interactive disc is a movie having a football game sequence. At the freeze frame groove 401 or before entering the freeze frame groove the user would be instructed that he may watch the football game, i.e., program B sequence, or skip through the football game watching a cheerleader sequence on the side lines, i.e., program A sequence. Of course, it should be noted that the claims of the present invention are not necessarily limited to the program sequences described herein. The sequences are limited only to the imagination of the software producer and the number of tracks that may be skipped reliably. Also, it should be noted that the programs are recorded on disc 12 such that sector S1 is field 1 of a color television frame, sector S2 is field 2, sector S3 is field 3, sector S4 is field 4, etc. Thus the phase of the color subcarrier is aligned from convolution to convolution.

The stylus kicker assembly will now be described with reference to Figures 5 and 6. Figure 5 illustrates a stylus-kicker assembly. In one embodiment, a stylus 35 having a signal pickup electrode thereon is contoured to engage a groove 36 in a spiral track 101 on record disc 12. Electrical contact to the electrode is made via flylead 38. The flylead 38 also produces a degree of pressure between the stylus and the record for tracking purposes. Stylus 35 is mounted to the free end of stylus arm 37, the opposite end of which is attached to the carriage mechanism 14 by a compliant coupling 39 which permits limited freedom of movement of the stylus arm in three dimensions. A permanent magnet 45 is fixedly mounted to the stylus arm 37 relatively near the stylus and arranged to be in the magnetic field lines emanating from the selectively energized electrode magnets or coils 46 when the stylus is in the play position. The coils 46 having nonmagnetic cores are electrically connected to produce aiding fields to impart a radial movement to magnet 45 and consequently movement of the stylus when the coils are energized.

The partial schematic partial block diagram of Figure 6 illustrates a kicker system for player 10 of Figure 2. In Figure 6 a microprocessor 56, assumed to include the requisite associative circuitry for normal operation responsive to system or program commands from the player controls, monitors the stylus position via track identification signals (DAXI) and applies inward or outward kick signals in accordance with the mode of playback. For example, if a particular video sequence is to be "frozen", at that point in the record playback the stylus is kicked one convolution or track outward for each revolution of the disc. The microprocessor 56 receives the track identification signals and interactive signals (DAXI) from the recognition circuit 54. A user input from the interactive remote 31 provided to microprocessor 56 is used to calculate the proper stylus position and determine the appropriate control signal adjustments to apply to the programmable pulse generator 28' and switch 47 to reposition the stylus in the direction of the proper or desired convolution of the spiral. Pulse generator 28' produces a ramp voltage proportional to the control signal applied by microprocessor 56 via input bus 58. The pulse generator output signal at connection 51 is applied to the reversing switch 47 for application to the stylus kicker coil 46. The reversing switch 47, controlled by the microprocessor 56 via bus 57 governs the

direction of current flow through the stylus kicker coil 46 and thereby the direction of the magnetic field created between the coils and consequently the direction of stylus movement.

Pulse generator 28' includes a current source circuit 49 providing a high impedance regulated current in a first mode and a low impedance connection to a reference potential in a second mode. When the current source is operated in the second mode the potential across capacitor 55 is clamped at the reference potential. Switching the current source 49 to its first mode causes the potential at connection 50 to monotonically increase in accordance with the charging rate of capacitor 55. The potential at connection 50 is buffered by amplifier 48 which generates the requisite range of output currents to drive the stylus kicker coil 46.

In one preferred embodiment of the interactive system of the present invention, track 101 of disc 12 is formed as a groove on the surface of the disc having groove walls of a predetermined shape (e.g., triangular). In this embodiment the stylus 35 is provided with a tip which is conformal to the groove formed in the disc. The conformal stylus/groove aids in the tracking of the stylus across the disc surface and the engagement of the stylus during a kicking operation.

Referring to Figure 7, a stylus 35 having a tip 701 is shown engaging a spiral groove 101 in a disc record 12. The triangular-shaped groove walls 703 and 705 guide the stylus tip 701 so that it rides in the bottom of groove 101. In general, with current technology it is possible to kick the stylus reliably only a limited number of grooves (e.g., ±2 groove convolutions). One of the advantages of an interactive system that has a grooved disc record is that the stylus tip will generally engage the selected groove if the bottom of the stylus 707 lands within the width of the groove. Consequently, a continuously-servoed control loop is unnecessary, thereby avoiding the cost of the servo, the low speed of response and possibility of instability. In Figure 7 the stylus tip is shown in phantom by reference numerals 701' and 701". At these extreme positions shown by the 701' and 701" the stylus may be expected to engage the groove convolution which resides below the tip. In this system the groove walls 703 and 705 of the spiral groove aid the stylus in acquiring the proper track. When the stylus shown in position 701' lands as shown in the groove it will be swept into the groove bottom by the guiding wall 705. On the other hand, the stylus shown in phantom 701" will be swept to the right into the groove bottom by the guiding wall 703 of the spiral groove. Thus, one of the advantageous features of the present invention is a conformal stylus with a record groove which enhances the positioning of the stylus in the proper groove when a kick is performed. This tends to be faster than use of a servo to position the stylus. It should be understood that the groove and stylus tip shape and size are not necessarily to scale. In commercial video disc players using grooved records the angle at the bottom of the groove is about 140°.

Figures 8 and 9 will be used to describe the digital information (DAXI) recorded on the disc surface for effecting a dancing routine. Particular details of an NTSC type television signal for use in a video disc system formated in accordance with the buried subcarrier technique are described in U.S. Patent No. 3,872,498, "Color Information Translating Systems", to D. Pritchard. In accordance with the NTSC format a vertical blanking interval separates the interlaced odd and even fields of a television frame. Referring to Figure 8, those skilled in the television arts will readily recognize the standard vertical blanking interval containing a first equalizing pulse interval, a vertical sync interval, a second equalizing pulse interval, followed by a number of horizontal line intervals at the start of each new field. The video signal information begins on line 22' of field 1 and on line 284' of field 2. The DAXI information representative of the field number and interactive information appears at line 17' of field 1 and line 280' of field 2. Digital information could, as well, be inserted in other lines of the vertical blanking interval. To show the details of the DAXI signal format, Figure 9 expands the time scale during the horizontal line containing data (line 17' or line 280').

Referring to Figure 9, data are represented in terms of luminance level: 100 IRE units is a logical "1" and 0 IRE units (blank) is a logical "0". The first data bit follows the standard horizontal sync pulse 901 and color burst 903. The frequency of the color burst 903 is about 1.53 MHz, the frequency of the buried subcarrier. Each data bit is transmitted synchronously with the 1.53 MHz buried subcarrier signal. The digital message comprises a 13-bit start code termed B(X), a 13-bit redundant error check code termed C(X), and 51 information bits termed I(X). The beginning of the next horizontal line is indicated by the next horizontal sync pulse 901a and color burst 903a. Thus, the individual data bits are synchronous with the color subcarrier, and the overall digital message is synchronous with the vertical sync pulse. Note that the data rate can be a multiple or submultiple of any convenient subcarrier frequency. Also, other values of luminance may be assigned to logic 1 and 0, or more than one bit may be associated with a given luminance level.

Details of the start code B(X), the error check code C(X) and the field number (18 bits) and band number (6 bits) are provided in U. S. Patent No. 4,308,557, "Video Disc System", to C. B, Dieterich. In a video disc system of a type described herein the field number and band number may be used for track error correction or other special features for the player, also this information conveys the first alpha-numeric (Figure 3a) providing current position of the stylus. In the Dieterich patent 27 unused information bits are described. The present system uses eight of those bits for the interactive data to perform the stylus dancing. The first four of the eight bits are used for the track identification number (second alpha-numeric of Figure 3a). This number is used to identify what kind of a picture is in the groove following the next vertical blanking interval. For example, a track of I. D. of 0 may indicate a frozen frame, a track I. D, of 1 through 16 may identify a particular program sequence. The next four bits of

the eight-bit interactive data are used to identify the displacement (third alpha-numeric of Figure 3a). The displacement is a signed number, that is, there can be an inward displacement on the disc or an outward displacement. So the first bit of the displacement will be representative of the direction of the displacement, for example, a "1" may represent an inward displacement and a "0" may represent an outward displacement. The next three bits of the four-bit displacement code indicates how many grooves are to be skipped. A displacement of "0" indicates no kick is needed to stay in the proper track while a displacement of 1, 2, etc. is used to indicate displacements of 1, 2, etc. groove displacements, respectively.

An illustrative sequence of events for determining the necessary kicker drive parameters for microprocessor 56 of Figure 6 is outlined by the flow chart of Figure 10. The routine does not include general system monitoring and kick control. This particular routine assumes that the stylus kicker arrangement for maintaining the proper groove is provided in accordance with U. S. Patent No. 4,330,879, "Adaptive Stylus Kicker Using Disc Track and Disc Sector Information", to C. M. Wine. The first process block 1001 in the flow diagram instructs the microprocessor to read DAXI and get the user input. After reading DAXI and fetching the user input, first decision block 1003 determines whether the track I. D. is equal to the requested track I. D. If the response is "no" then decision point 1005 determines whether the user had made an input since the last DAXI read. If "yes" then the video is blanked and audio is muted 1007 and normal play is continued. If the response is "no" at decision point 1005 the player continues normal play 1009. If the response at descision block 1003 is "yes" then decision point 1017 is reached. At point 1017 the determination is made whether the user has just made an input. If "yes" go to unset flag block 1019. This flag indicates whether or not the user has just made an input. From unset block 1019 the player goes to unblank block 1011 where the video is unblanked and the audio unmuted. If, on the other hand, the user has not made a recent input block 1011 is reached unblanking the video and unmuting the audio. Decision block 1013 determines whether the displacement is equal to 0. If "yes" the player goes to normal play 1009, if "no" the player goes to process block 1015 where a kick by the amount of displacement is effected and the player continues in normal play 1009.

The operation of the player will be explained with reference to the flow diagram of Figure 10. In normal cases where the user has not recently made an input the player will encounter a matching track I.D. from time to time (this path is "yes" from 103 and "no" from 1017). When this occurs the video is unblanked by block 1011 and the displacement will be effected to cause the stylus to remain in the selected track. In this normal case the player may encounter a mismatched track I.D. (No branch from block 1003).In this case at block 1005 as the user has not made an input the player continues normal play. Thus the normal operation is that the user sees the selected track. In the freeze frame mode the player will encounter a displacement of −1 causing the stylus to kick back to maintain the freeze frame.

In the case where the user has just made an input to select a particular program sequence a flag has been set in block 1001. In general, the track I.D. will not equal the requested track I.D. thus the player will take the "no" branch from block 1003 and the "yes" branch from block 1005 so that the video is blanked. Then the player continues normal play. When the stylus is positioned so that the track I.D. equals the requested track I.D. the player will take the "yes" branch from block 1003. As a result of taking the "yes" branch from block 1017 the user flag will be reset and the video unblanked. Depending upon the displacement instruction the player will follow path 1013, 1015, 1009 or 1013, 1009.

While the description provided herein includes one track I.D. and displacement it should be appreciated by those of skill in the art that more than one set of track I.D.'s and displacements could be provided in a vertical blanking interval. This may be advantageous in providing more rapid track switching.

A block diagram of a video disc encoder for encoding information in a form suitable for mastering of interactive discs is shown in Figure 11. A composite video signal is provided by source 1101. Source 1101 may be a tape recorder including a tape that has been prepared using studio type editing equipment where the interactive data is intermingled on the tape in accordance with the manner in which it will be intermingled on the spiral track on the disc surface. The composite video signal is combined in adder 1103 with a digital data bit stream on conductor 1105 supplied by the digital data generator 1107. Synchronizing means 1109 supplies a color subcarrier and synchronizing pulses so that the data bits generated by the digital data generator 1107 are synchronous with the color subcarrier appearing at terminal 1111 and so that the digital message is encoded on the proper horizontal line in the vertical blanking interval. Information bits, appearing at data bus 1113 and 1115 and representing the video field number, band number and interactive data are provided by apparatus 1117. Apparatus 1117 may be a computer which is providing the field band and interactive data responsive to a SMPTE time code supplied by the sorce 1101. The digital data and the video signal are combined in adder 1103. Further signal processing means 1121 conditions the composite video for the recording medium. The composite video signal is of the buried subcarrier type and is recorded using FM modulation techniques. The signal is supplied to cutterhead 1146 which cuts a groove and signal information simultaneously into a metal substrate 1123. Relative motion is established between the cutterhead 1146 and substrate 1123 by rotation of the turntable 1125 in response to the rotation of drive motor 1127. Discs for consumer use are generated from the metal substrate 1123 by techniques well known in the record stamping industry.

In the system of the present invention, it should be noted that the skips through the intermingled programs are performed just before the vertical blanking interval. In a grooved video disc system wherein the

skip is performed within a range of convolutions that may be reliably skipped among, it is believed that the skipping operation can be performed in approximately 1 millisecond. If the skip is initiated approximately 15 horizontal lines before the vertical blanking interval the viewer will notice little or no effect during the skip.

Figure 12 shows another program sequence which may be recorded on an interactive disc. Referring to Figure 12 an arrangement is shown for recording up to sixteen programs (A - P) on an interactive disc. The freeze frame FF is formed on the disc comprising two convolutions. That permit access to any of the sixteen programs with a skip of two convolutions or less. The skip sequence for this interactive disc involves play of one field followed by a skip of two convolutions.

Further it should be noticed as described previously that in an intermingled disc that, in general if the stylus is not in the proper track at the proper time that by merely waiting for a duration of less than one convolution the stylus will generally end up in the program material which was selected. Thus, if the user does lose video generally it may be corrected within one rotation of the turntable which is within four frames of video in the system as described in detail herein.

While the embodiments described include specific examples with respect to the software described herein these sequences are not meant to be limiting. It should be obvious to one of skill in the art that many skipping sequences for various program schemes fall within the teachings and claims of the present invention. For example, more than sixteen program sequences may be recorded by using a single freeze frame convolution. In this arrangement the initial skip into a program would be coded by use of a user input. This could be accomplished by the announcer on the disc instructing the user to provide an input which would be used to kick the stylus into the chosen program sequence. Further it should be noted that the stylus dancing routines described herein have been described with reference to the stylus kicking inwardly on the disc. Of course, there are many programs wherein one may wish to skip outwardly on the disc. For example, with respect to the football game/cheerleader sequence one may want to skip outwardly with the cheerleader sequence so that the football sequence could be watched on the inward rotation.

CLAIMS

1. In a disc system having a transducer for reproducing information signals recorded in a spiral track in a disc-shaped record medium, wherein rasters of information are recorded in segments of said spiral track for producing a visual display, apparatus comprising:

kicker means, cooperating with said transducer, for effecting motion of said transducer such that said transducer skips from a first convolution where said transducer transduces said information signals prior to a skip to a second convolution where said transducer transduces said information signals subsequent to said skip;

branching means for enabling said transducer so that said transducer branches from a first raster sequence to a second raster sequence;

control means for providing control signals for controlling said kicker means so that said kicker means urges said transducer to follow a predetermined path along said spiral track, whereby as said transducer follows said predetermined path said second raster sequence selected by said branching means is displayed on a display means.

2. An apparatus according to Claim 1 wherein said spiral track is formed as a groove having a stylus guiding wall in a surface of said record medium and wherein said transducer comprises a stylus having a slope conformal to said groove, which engages said groove during information recovery, said stylus-groove combination reducing the amount of searching between tracks, whereby the groove guiding wall aids the stylus to engage a selected convolution when the stylus is proximate said selected convolution at the conclusion of said skip.

3. An apparatus according to Claim 2 wherein said groove has a triangular shape.

4. An apparatus according to Claim 1 or 3 wherein said transducer skips from said first convolution to said second convolution during an interval of said video signals when said display is blanked.

5. An apparatus according to Claim 4 wherein said interval is said vertical blanking interval of a television signal.

6. An apparatus in accordance with Claim 2 wherein said kicker means and said control means constitute a controlled open-loop track skipping means.

7. An apparatus according to any preceding claim wherein said apparatus includes reading means, responsive to address information, for identifying the position of said transducer with respect to the information being recovered, and generating means for generating a control signal for following a desired raster sequence, said signal from said generating means being based on the position of said transducer, as determined by said reading means, prior to the initiation of said desired raster sequence and on the location of information to effect said desired raster sequence.

8. An apparatus according to any preceding claim wherein portions of said first and second raster sequences are interlaced so that said control means is effective to produce substantially continuous information during transition from said first raster sequence to said second raster sequence.

9. In a disc playback system having a transducer for reproducing information signals recorded in a spiral track in a disc-shaped record medium, an apparatus comprising:

digital data receiving means responsive to said information signals for reading a first data word corresponding to a first position of said transducer with respect to said record medium, a second data word corresponding to a predetermined raster sequence and a third data word corresponding to the

displacement required to relocate said transducer from said first position to said raster sequence;

input means for providing an input word to said digital data receiving means for selecting said predetermined raster sequence; and

kicker means, cooperating with said transducer, for effecting motion of said transducer, said kicker means effecting said motion when said input word from said input means corresponds to said second data word so that said transducer is relocated from said first position to said raster sequence by said displacement.

10. Apparatus substantially as hereinbefore described with reference to Figures 1 to 10 and 12 of the accompanying drawings.

11. A disc record having a program format substantially as hereinbefore described with reference to Figures 3, 8 and 9.

12. An encoder substantially as hereinbefore described with reference to Figure 11.

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